**Abstract**

We introduce an analogue of the Ducci game that involves $d$-tuples of prime numbers subjected to the iteration $G$ sending such a $d$-tuple $(p_1, p_2, \ldots, p_d)$ into $(\mathrm{gpf}(p_1 + p_2), \mathrm{gpf}(p_2 + p_3), \ldots, \mathrm{gpf}(p_d + p_1))$, where for any $x \geq 1$, $\mathrm{gpf}(x)$ represents the greatest prime factor of the integer $x$. We show that the iteration of $G$ always leads into a limit cycle $C$. Moreover, if $C$ has length greater than 1, then not only every vector in $C$ has all components in $P_0 := \{2, 3, 5, 7\}$, but every element of $P_0$ appears as a component of some vector in $C$. An analysis of the lengths of the nontrivial cycles for small values of $d$ is provided.